

Time :- 3 hours.

Marks :- 100

XYGADE

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Statistics

- N.B.:-
1. All questions are compulsory.
 2. Bracketed figures to the right indicate full marks.
 3. Use of non programmable calculator is allowed.
 4. Graph papers will be provided on request.

- Q.1 A) Choose correct Answer for the following (ANY FIVE) (10)
- i) In Linear programming problem (L.P.P) constraints can be represented by :-
 - a) Equalities
 - b) inequalities
 - c) ratios
 - d) both a and b
 - ii) While solving a L.P.P a minimization problem can be converted into a maximization problem by changing the sign of coefficients of decision variables in the _____
 - a) Constraints
 - b) Objective function
 - c) both a and b
 - d) none of the above.
 - iii) Graphical method can be applied to solve L.P.P when there are only _____ variables.
 - a) Zero variables
 - b) two
 - c) more than three variables
 - d) three
 - iv) A necessary and sufficient condition for the existence of a feasible solution to the general transportation problem is that _____
 - a) Total Supply \neq Total Demand
 - b) Total Supply $<$ Total Demand
 - c) Total Supply $>$ Total Demand
 - d) Total Supply = Total Demand
 - v) For a salesman who has to visit n cities, following are the ways of his tour plan:-
 - a) n ways
 - b) $n!$ ways
 - c) $(n+1)!$ ways
 - d) $(n-1)!$ ways
 - vi) The assignment problem can be solved by using :-
 - a) Transportation method
 - b) Johnson's method
 - c) Hungarian method
 - d) All of the above.
 - vii) If the job is preferred on two machines M_1 and M_2 in the order M_1M_2 , then the difference between total elapsed time and the time when last job in sequence finishes on M_1 is

- a) Idle time for machine M_2
- b) total elapsed time for machine M_1
- c) idle time for machine M_1
- d) total elapsed time for machine M_2

B) Answer the following in one / two sentences (ANY FIVE) (10)

- (i) Define slack variable.
- (ii) Why do you need artificial variable in linear programming problem
- (iii) When does the alternate solution exist in transportation problem?
- (iv) What is Rim condition, in Transportation problem?
- (v) What is meant by balanced assignment problem?
- (vi) Give an example of assignment problem.
- (vii) Give one example of sequencing problem in your daily life.

Q.2 Attempt Any two sub-questions from the following :- (20)

- a) Define the following terms with reference to L.P.P:- (10)
- i) Solution to L.P.P
 - ii) Feasible Solution.
 - iii) Basic feasible solution
 - iv) Optimum basic feasible solution.
 - v) Unbounded solution.

- b) CIPLEZ Company manufactures two brands of antibiotic capsules P and Q which were prescribed to the typhoid patient. P contains 2 units of ampicillin and 1 unit of cloaxicillin. Capsule Q contains 1 unit of ampicillin and 3 units of cloaxicillin. It is found that 2 units of ampicillin and 3 units of cloaxicillin are required to get immediate relief from the infection. The cost of capsule P is Rs 12/- and that of capsule Q is Rs. 14/-. Formulate the L.P.P and solve graphically to find the number of capsules a patient should take to get immediate relief at minimum cost. (10)

- c) Solve the following L.P.P by simplex method :- (10)
- Max $Z = 5x_1 + 3x_2$
- Subject to
- $3x_1 + 5x_2 \leq 15$
- $5x_1 + 2x_2 \leq 10$
- $x_1 \geq 0, x_2 \geq 0$

Q.3 Attempt Any two sub-questions from the following :-

- a) i) What is an unbalanced transportation problem? Explain how to transform an unbalanced transportation problem into balanced transportation problem. (5)
- ii) Explain the difference between a transportation problem and an assignment problem. (5)

b) Solve the following transportation problem using :-

i) North west corner rule.

ii) Least cost method.

	Destination				
ORIGIN	D ₁	D ₂	D ₃	D ₄	Capacity
O ₁	6	5	1	3	100
O ₂	4	8	7	2	125
O ₃	6	3	9	3	75
Demand	70	90	80	60	

- c) A company has 4 warehouses and 6 stores, the cost of shipping one unit from warehouses i to store j is c_{ij} and the requirements of the six stores are 4,4,6,2,4,2 and quantities at warehouses are 5,6,2,9. Find the minimum cost solution. (10)

Stores:-	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆
Warehouses						
W ₁	7	10	7	4	7	8
W ₂	5	1	5	5	3	3
W ₃	4	3	7	9	1	9
W ₄	4	6	9	0	0	8

Determine whether degeneracy occurs in the solution obtained, if so explain how will you resolve degeneracy in the above example.

Q.4 Attempt Any two sub-questions from the following :- (20)

- a) i) Explain an assignment problem. (10)
- ii) Give the mathematical form of an assignment problem.

b) A company has 4 machines to do 3 jobs. Each job can be assigned to Only one machine. The cost of each job – machine combination is given in the table below in Rupees (10)

	MACHINES			
JOB	I	II	III	IV
A	9	12	14	18
B	4	6	8	9
C	5	7	9	11

Find an optimal assignment which will minimize the cost.
 Answer the following questions with justification :-

- (i) Is there any alternate optimal assignment?
 - (ii) Is it possible to maintain the same minimum cost as per optimal solution if job B is assigned to either Machine II or Machine III?
 - (iii) Does any machine remain idle as per optimal assignment?
- c) (i) What is no passing rule in a sequencing algorithm? (2)
 (ii) We have seven jobs each of which has to go through the machine M_1 and M_2 in the order $M_1 M_2$. Processing times (in hours) are given as :- (8)

Job :	1	2	3	4	5	6	7
Machine M_1 :	3	12	15	6	10	11	9
Machine M_2 :	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T.

Q.5 Attempt Any two sub-questions from the following :- (20)

a) Solve the following L.P.P graphically :- (10)

Minimize $Z = 3x + 2y$
 Subject to $2x + y \geq 4$
 $2x + 3y \geq 6$
 $6x + y \geq 6$
 $x \geq 0, y \geq 0$

b) A company has three factories F_1, F_2, F_3 with capacities of 200, 150 and 250 units. It has three warehouses W_1, W_2 and W_3 with demands of 250, 150 and 200 units. Unit cost of transportation is given in the table below. Find optimal transportation schedule and optimal transportation cost. (10)

	W_1	W_2	W_3
F_1	14	12	9
F_2	8	10	13
F_3	11	16	7

c) We have five jobs each of which must go through the machines A, B and C in the order ABC :- (10)

Processing Time (in hours)

Job . No	1	2	3	4	5
Machine A :	5	7	6	9	5
Machine B :	2	1	4	5	3
Machine C :	3	7	5	7	

Determine a sequence for the jobs that will minimize the total elapsed time. Also determine the minimum total elapsed time.